

Mined Land Reclamation on DOE's Uranium Lease Tracts, Southwestern Colorado

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Staff of the U.S. Department of Energy (DOE) Uranium Leasing Program (ULP) manage 32 uranium lease tracts in southwestern Colorado. Since 1995, reclamation specialists have been monitoring the success of reclamation practices that have been conducted on the lease tracts. Typical activities associated with reclamation have included the regrading of waste rock dumps; closure of open portals, shafts, and vents; and revegetation of disturbed areas. Reclamation efforts have been mostly successful, especially considering the harsh environment in which the lease tracts are located.

The southwestern Colorado area is characterized by low precipitation and humidity, high evaporation, sunny days, clear nights, and extreme daily temperature changes. Annual precipitation ranges from 7 to 12 inches, and monthly precipitation may range from zero to several inches. Elevations of the mesas and valleys throughout the area vary from 5,500 feet above sea level in the valleys to approximately 8,000 feet on top of the higher mesas. Soil textures range from sandy to clayey and often contain high concentrations of coarse fragments. Sagebrush-grass and piñon-juniper plant communities dominate the terrain.

Following is a brief description of tools and methods that have worked well for reclaiming mine sites on the uranium lease tracts.

- ULP personnel have developed a method for regrading waste rock dumps that has resulted in a more natural-looking landscape. First, the area around the dump is dug out with a trackhoe or bulldozer, creating a trench or basin around the dump. Often, enough topsoil material is salvaged from the trench area to cover the regraded surface. Waste rock is then bulldozed into the trench until slopes are flattened, usually to a slope less than 4:1 or 5:1, if possible. The trenching allows the waste rock to “disappear” into the surrounding landscape. Additionally, the shallower slopes associated with this method result in less erosion potential.
- ULP personnel also have determined that a rough, finished surface (versus a smooth surface that typically is desired in landscaping) increases reclamation success. The microtopography created by a roughened surface enhances seed germination by trapping precipitation and runoff. Roughened surfaces are usually achieved by pocking the surface with a trackhoe bucket (Photos 1 and 2) or ripping with bulldozer ripper blades (Photo 3). The roughened surface also decreases the potential for soil movement off site. Sediments eroded by runoff travel only short distances and are deposited in either pocks or basin areas on the surface of the regraded area.
- After an area is regraded, ULP personnel assess the landscape for drainage. Rerouting off-site drainage away from the reclaimed area has been a successful method for avoiding soil erosion and maintaining the integrity of the pocks or roughened surface on the regraded area. In some situations, runoff cannot be rerouted around the reclaimed area; instead, a drainageway is built through the reclaimed area and armored with local rock.



Photo 1: View of pocked waste rock dump 2 years after reclamation



Photo 2: Close-up view of pocked waste rock dump 2 years after reclamation



Photo 3: View of a ripped sideslope 4 years after reclamation

- If the area to be regraded contains large boulders, these are set aside during regrading activities and used later to “landscape” the surface. The placement of large boulders on the surface is visually more interesting, but more importantly, the boulders create microenvironments that provide wildlife habitat and enhance seed germination, plant growth, and species diversity. If the regraded waste rock dump is located on a steep slope with rock outcrops, often the boulders will be placed in a row, side by side, to imitate a rock outcropping. This practice has led to more natural-looking landscapes.
- Whole trees and tree limbs also have been used to landscape regraded areas. Like the boulders, they provide microenvironments for plants and wildlife. During the reclamation assessments, ULP personnel noted that vegetation cover and species diversity are almost always greater beneath downed trees or tree limbs than in open areas.
- The placement of topsoil on regraded areas has a tremendous effect on the success of the revegetation. ULP personnel have been imaginative and resourceful in finding local sources of topsoil; often, sediments deposited in stock ponds are cleaned out and used as topsoil. In other situations, topsoil is borrowed from an undisturbed area containing deep soils. It is critical, however, that the borrow area be free of weedy species and weed seed. These borrow areas are reclaimed in the same manner as mine site features. ULP personnel have noted that often only a few inches or a “dusting” of topsoil is sufficient for dramatically increasing revegetation success. Field crews have casually observed that revegetation is equally successful whether a site is backfilled with 2 inches of topsoil or with 6 inches of topsoil.

- When topsoil is not available for a site, the application of soil amendments increases the potential for revegetation success. ULP personnel have seen positive results from the use of Biosol and Granular Humate. A minimum application rate of 1,800–2,000 pounds per acre of Biosol and 1,000 pounds per acre of Granular Humate is recommended for harsh sites. At one site, cattle were used to amend poor soils. After hand-broadcasting seed, cattle were brought onto the site to “stomp in” the seed and hay that was used as feed. The cattle left behind manure, which enriches the soil, and small pocks or hoof-prints that retain precipitation. Hay fed to the cattle (before and during the project) must be certified as weed free to avoid an infestation of undesirable weeds on the project site.
- Seed is normally applied by hand-broadcasting, mainly because the regraded areas are too rough and rugged to accommodate equipment. Because the surface of regraded areas is left in a rough condition, broadcast seed does not blow away but is trapped in crevices and basin areas.
- The native seed mix (see Table 1) used at most of the mine sites has been very successful; all species seeded are found on most of the reclaimed sites.

Table 1. Native Seed Mix Used on DOE Uranium Lease Tracts

Species		Broadcast Application Rate (pounds. PLS ^a / acre)
Scientific Name	Common Name	
<i>Pascopyrum smithii</i>	Arriba western wheatgrass	4.0
<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	Slender wheatgrass	2.0
<i>Achnatherum hymenoides</i>	Paloma Indian ricegrass	4.0
<i>Bouteloua gracilis</i>	Hachita blue grama	2.0
<i>Pleuraphis jamesii</i> (florets)	Galleta grass	2.0
<i>Hesperostipa comata</i> ssp. <i>comata</i>	Needle-and-thread grass	1.0
<i>Nassella viridula</i>	Lodorm green needle grass	2.0
<i>Linum lewisii</i>	Lewis flax	1.0
<i>Penstemon palmeri</i>	Cedar Palmer penstemon	0.5
<i>Sphaeralcea coccinea</i> or <i>Sphaeralcea parvifolia</i>	Scarlet or Parvifolia globemallow	0.3
<i>Atriplex canescens</i>	Rincon fourwing saltbush	3.0
<i>Krascheninnikovia lanata</i>	Winterfat	1.0
Total pounds per acre		22.8

^aPLS = pure live seed

- ULP personnel have experimented with the use of a cover crop. Both Regreen, a sterile hybrid of wheat and wheatgrass, and a combination of Rocky Mountain beeplant and sunflower have been used. Although Regreen germinates very well and provides a thick cover of grass during the first growing season, to date no noticeable differences in long-term reclamation success have been observed between sites having a Regreen cover crop, sites having a beeplant/sunflower cover crop, and sites having no cover crop.
- ULP personnel have learned that successful reclamation usually takes 3 years to achieve. Annual weeds typically dominate a site during the first growing season; annual weeds and seeded species typically share the total plant cover during the second growing season; and

seeded species normally dominate the site during the third growing season. Particularly arid sites may take 5 years before they are considered successfully reclaimed. In reclamation, patience is a critical virtue.

- Weed control efforts, primarily the spraying of herbicide, have been very effective in reducing, and often eradicating, populations of noxious weeds.